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THE USE OF GEOGRAPHIC INFORMATION SYSTEMS IN IDENTIFYING POTENTIAL WILDLIFE HABITAT[1]

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(*With 6 plates*)

The possibilities of using a Geographic Information System and Systematic Reconnaissance Flight in wildlife conservation is discussed. Potential habitats for four key wildlife species of the Dangs District have been identified using these techniques. The model is based on five habitat parameters which were assessed during the SRF. Analysis of this data was carried out using the GIS software ARC/INFO and results obtained in the form of grid maps showing habitat suitability.

INTRODUCTION

This paper discusses how a Geographic Information System (GIS) and Systematic Reconnaissance Flight (SRF) can be used to predict locations of potential habitat for wildlife. The technique can be especially useful in large areas where it is not possible to carry out intensive field studies over the entire area due to constraints of time or funds. In this case, the study area is the Dangs District in South Gujarat, an area of approximately 1800 sq.km (Fig. 1). Potential habitats for four key species, namely Tiger (*Panthera tigris*), Spotted Deer (*Axis axis*), Rustyspotted Cat (*Felis rubiginosa*) and Giant Squirrel (*Ratufa indica dealbatus*) have been mapped. Each of these species is extremely rare in the Dangs and, in fact, the giant squirrel is known only from past reports (Appendix I). The main purpose of this paper, however, is not to identify actual habitats of these species, but to demonstrate how GIS and SRF can be used as tools in wildlife conservation.

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GEOGRAPHIC INFORMATION SYSTEMS

A GIS is usually a computer based system used for storing,manipulating and analysing large volumes of spatial data. The geographic database can be stored in the form of thematic maps and related attributes such as site data, topographic data, land use types and linear structures. These data can then be retrieved as required, manipulated, overlaid and presented in a map or table form for a specific purpose.

One of the important functions of a GIS is to allow the results of data processing for intensive test areas to be transferred over the entire study area. In this way, the characteristics of the entire study area can be mapped in one form in one databank which can be easily manipulated for later computer modelling (Haber & Schaller 1988).

However, in this particular case, a different approach was used. Information on the habitat requirements of the target species was obtained both from literature and from actual field surveys carried out in the Dangs. The data obtained was used to prepare models of the possible distribution of the Tiger, Spotted Deer, Rustyspotted Cat and Giant Squirrel. These models can later be checked in the field and updated as required. The GIS thus provides some basic guidelines on where the species are likely to occur, and identifies areas where specific management to protect their habitat is likely to provide maximum conservation gains.

Methodology

The study was carried out in two main phases:
1. An aerial survey was carried out over the entire study area. Sixteen parallel north–south transects were flown over the study area at an altitude of 300 m above the highest point on each transect. (However, due to operational difficulties and the hilly nature of the terrain, transects 6, 8 and 9 could not be completed. These gaps in the information can be filled in by ground checking). Visual observations on key habitat parameters were recorded continuously along the length of each transect on a proforma. These observations were divided into 30 second subunits. The information collected in this manner was then transferred onto a series of grid maps of the Dangs wherein each grid cell corresponded to one subunit. The size of the grid cells was calculated based on the speed of the aircraft and elapsed time. Each grid cell corresponds to approximately 4.5 sq.km. Since a relatively simple and coarse grained system based on systematic grid square sampling was used, it necessitated the use of major habitat variables only. We used two physical variables: topography and degree of dissection; two vegetation variables: vegetation type and cover values, and the pattern and intensity of land use. Water is not a limiting factor in the Dangs. We believe these variables can present an adequate overview of large mammal habitat.
2. The information from these maps was later entered into a database file and models were built to demonstrate habitat requirements for each of the species. These models were based on the five habitat variables that were recorded during the flight. The habitat requirements were based on actual sightings of the species, reports from the area and information obtained from literature.

The GIS software ARC/INFO (ESRI-California 1983) was used to process this data. First a grid of the required size and structure was generated. The information from the database file was then superimposed onto this grid and coded to obtain a set of maps showing the various habitat parameters. The constraints for habitat requirements for each species were entered in the required format and four maps showing the potential habitats for each species were generated. Finally, by overlaying these four maps, a single map showing the combined habitat requirements for all four species was obtained.

Results

Figs. 2-5 show the classification of the different habitat parameters as recorded during the aerial survey. Fig. 2 shows topographical features which are classified into five categories, namely, ridge, slope, plain, valley and catena. (A feature was classified as a catena when it consisted of a combination of features which could not be classed into any one category). Fig. 3 depicts the degree of slope of each of these features and is classified into flat, gentle, undulating, steep or precipitous slopes. Fig. 4 shows the amount of vegetation cover and is divided into three percentage classes, 1-30%, 31-70% and > 70%. Fig.5 shows vegetation type, which has been simplified into five classes. These are:

Forest: Most of the area covered by natural forest or old plantation which cannot be differentiated from a forest from the air.

Permanent (P) Field: Fields with regular, distinguishable boundaries and few lopped trees within them.

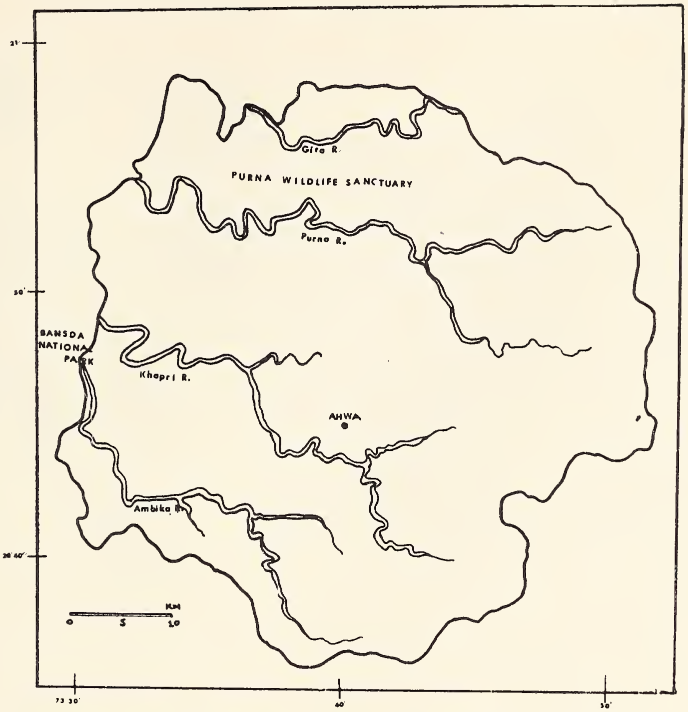
Temporary (T) Field: Fields with no distinguishable boundaries and with several lopped trees within them.

Forest/Agriculture: Part of the area under forest cover and part of it under P. or T. Fields.

Plantation: Teak or bamboo or mixed plantation, usually quite young.

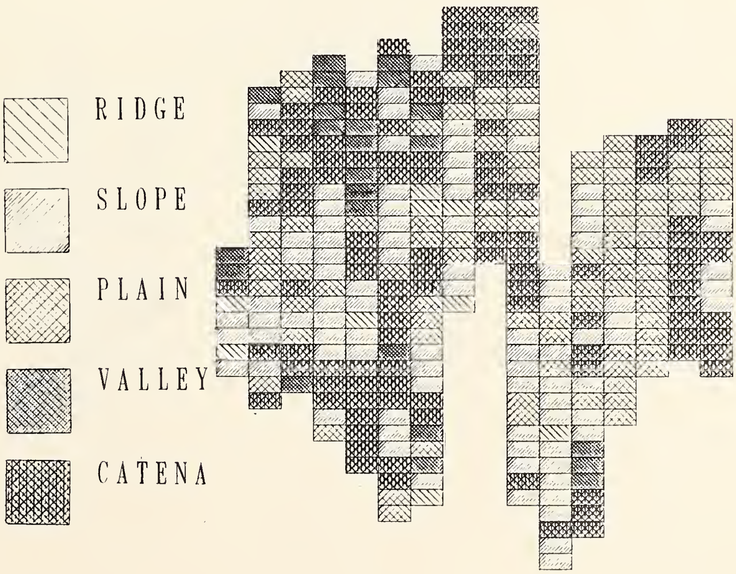
Fig. 6 shows the intensity of agriculture, which has been divided into four percentage classes, 0%, 1-30%, 31-60% and > 60%. The models for the habitat requirements for the four species are based on combinations of these 22 habitat variables and are summarised in Table 1. A high and medium quality combination is used for each species.

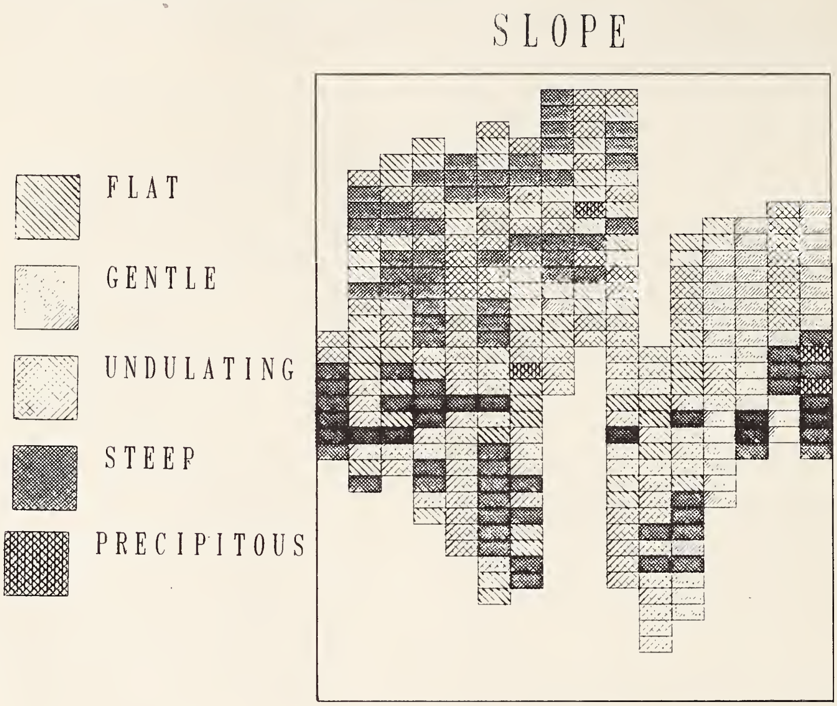
For instance, for the tiger, high quality habitat must have the following characteristics: topography can be either a ridge, slope, plain, valley or catena; the slope should be flat, gentle or undulating; cover should be > 70%; vegetation should be forest, and agriculture 0% For medium quality tiger habitat, the

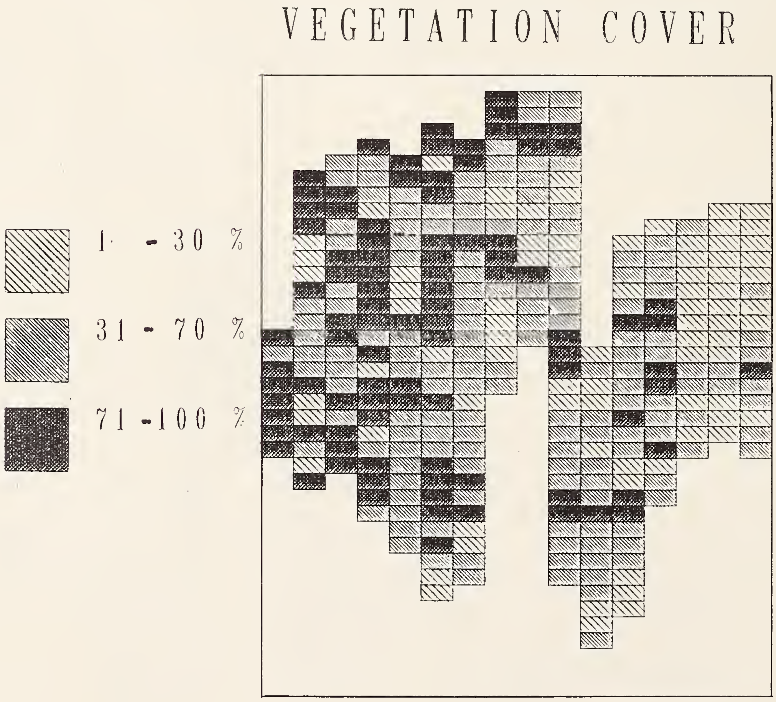


THE DANGS — showing locations of Purna Wildlife Sanctuary & Bansda National Park.

TOPOGRAPHY




SLOPE
FLAT
GENTLE
UNDULATING
STEEP
PRECIPITOUS


VEGETATION COVER
1 - 30 %
31 - 70 %
71 -100 %